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Recent Advances in Science in Western Australia

Earth Sciences

W K Witt of the Geological Survey of Western Australia, Perth, describes how the Menzies-Kambalda region has produced 1700 tonnes of gold, with most production accounted by mafic rocks, especially Fe-rich basalt and differentiates of fractionated sills. Mineralization occurs in diverse structural settings, related to the latest stages of regional deformation or emplacement of comtemporaneous granitoid intrusions, that were active during gold-related hydrothermal activity.

Witt W K 1993 Gold mineralization in the Menzies-Kambalda region, Eastern Goldfields, Western Australia. Geological Survey of Western Australia. Report 39.

Two iridium anomalies have been identified by R S Nicoll (AGSO Canberra) and P E Playford (GSWA Perth) near the Frasnian-Famennian boundary in the Canning Basin reef complexes, one above and one below the actual boundary; neither were associated with the extinction event in the *Palmatolepis linguifirmis* Zone. The anomalies were associated with beds containing abundant *Frutexites* microstromatolites, indicating that the iridium was probably organically concentrated, rather than being associated with an impact event.

Nicoll R S & Playford P E 1993 Upper Devonian iridium anomalies, conodont zonation and the Frasnian-Famennian boundary in the Canning Basin, Western Australia. Palaeogeography, Palaeoclimatology, Palaeoecology 104:105-113

Coworkers from Durham and Oxford (U. K.) used laboratory studies of quantifiable rock geotechnical parameters to understand slope form and development. Highly concave slopes have formed in limestone, which has little deformation before yield, whereas convexo-concave slopes are characterized by material with a greater strain before yield, a relatively low modulus of elasticity, and a pronounced discontinuity pattern.

Allison R J, Goudie, A S, & Cox N J 1993 Geotechnical properties of rock masses: their control on slope for, and mechanisms of change along the Napier Range, Western Australia. Geomorphology 8:65-80

A simplified scheme is presented by J R Vearncombe, of the University of Western Australia, to categorize quartz vein morphology from gold deposits, based on the growth direction of quartz or pseudomorphed chalcedony in the veins, into seven types; face-control, displacement-control, parallel-control, radiating, non-directional-control, replacement, and modified. Crustal depth is a major control in the Yilgarn Craton deposits, with parallel and radiating textures near the surface, displacement and non-directional typical of mid-crustal, frontal from near surface to midcrustal, and replacement and modified at all crustal levels.

Vearncombe J R 1993 Quartz vein morphology and implications for formation depth and classification of Archean gold-vein deposits. Ore Geology Reviews 8:407-424

Ten articles concerning a variety of topics have been published in the latest Professional Paper volume of the Geological Survey of Western Australia, including five of hydrogeological interest; Salinity control at Lake Toolibin (M W Martin); Hydrogeology of the Cervantes-Lancelin Region (A M Kern); Point sources of groundwater contamination in the Perth Basin (K-J Hirschberg); Municipal waste disposal in Perth and its impact on groundwater quality (K-J Hirschberg); Hydrogeology of the Collie Basin (J S Moncrieff).

Professional Papers. Geological Survey of Western Australia. Report 34

Life Sciences

A survey of the tick load in natural populations of sleepy lizards in South Australia, by M. Bull and D Burzacott of Flinders University, showed that lizards do not appear to be adversely affected by high tick loads, as neither size nor longevity was negatively correlated with tick load, and mating pairs had higher tick loads than non-mating individuals.

Bull C M & Burzacott D 1993 The impact of tick load on the fitness of their lizard hosts. Oecologia 96:415-419

The diets of arid zone dasyurid marsupials are shown by D Fisher and C Dickman, of the University of Sydney, to consist primarily of beetles, spiders, scorpions and centipedes. Small dasyurids avoided beetles with hard cuticles, and generally preferred prey 5 to 7.5 mm long over smaller (<2.5 mm) prey.

Fisher D O & Dickman C R 1993 Diets of insectivorous marsupials in arid Australia: selection for prey type, size or hardness? Journal of Arid Environments 25:397-410

The pattern of torpor of the Eastern pygmy possum was shown by F Geiser of the University of New England to be regular in the laboratory, with increasing occurrence at lower air temperatures. The duration of torpor lengthened with lower air temperature, to about 17 days at 5 C, and the minimum metabolic rate declined to less than 2% of the basal rate.

Geiser F 1993 Hibernation in the Eastern pygmy possum, *Cercartetus nanus* (Marsupialia: Burramyidae). Australian Journal of Zoology 41:67-75

A model of water regulatory efficiency developed for granivorous parrots by R MacMillen, of the University of California at Irvine, and R Baudinette of Flinders University, suggests that small size imparts a higher water efficiency, but requires them to rely on small seeds rich in carbohydrates, as these provide maximal yields of metabolic water.

MacMillen R E & Baudinette R V 1993 Water economy of granivorous birds: Australian parrots. Functional Ecology 7:704-712

The collembolan faunas of rehabilitated bauxite mines are shown by P Greenslade (CSIRO, Canberra) and J Majer (Curtin University) to have increased species richness in larger plots, with greater plant species richness and percentage plant cover; their results provide directions for improving rehabilitation practices.

Greenslade P & Majer J D 1993 Recolonization by Collembola of rehabilitated bauxite mines in Western Australia. Australian Journal of Ecology 18:385-394

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The standard metabolic rate of Western Australian frogs was shown by P Withers of the University of Western Australia to be similar to that predicted for other anurans. Species of *Neobatrachus* and *Cyclorana* had a depressed metabolic rate (to 20-30% of standard) during aestivation.

Withers P C 1993 Metabolic depression during aestivation in the Australian frogs, *Neobatrachus* and *Cyclorana*. Australian Journal of Zoology 41:467-473

Physical Sciences

Chemists from the School of Mathematical and Physical Sciences at Murdoch University have developed a potentiometric titration method and determined copper (I) equilibrium constants in aqueous solution for cyanide and D-penicillamine complexes. The copper (I) solutions are prepared by reduction of the common copper (II) state with excess copper metal, and are stabilised by chloride.

Hefter, G T, May P M & Sipos P 1993 A general method for the determination of copper (I) equilibria in aqueous solution. Journal of the Chemical Society Chemical Communications:1704-1706

An experimental and theoretical study, by physicists of the University of Western Australia and Murdoch University, of the angular correlations of sequential cascading photons in an atomic hydrogen system with a defined scattering plane demonstrates that the measured correlations and the deduced multiple moments show an order-of-magnitude agreement with various theoretical models.

Williams J F, Kumar M & Stelbovics A T 1993 Angular correlations between sequential cascading photons from n=3 atomic hydrogen. Physical Review Letters 70:1240-1243

Polarized neutron diffraction experiments at low temperatures in a high magnetic field have been used by researchers at the University of Western Australia, the Royal Institution (UK) and the Institut Laue-Langevin (France) to study the anisotropy of the orbital moment of the low spin hexacyanoferrate (III) ion. The data are consistent with a cubic crystal field model in which the magnetization is dominated by the orbital moment.

Day P, Delfs C D, Figgis B N, Reynolds P A & Tasset F 1993 Polarized neutron diffraction from $Cs_2KFe(CN)_6$ Molecular Physics 78:769-780

The structure of hydrogenated amorphous silicon, an important photovoltaic material, has been modelled by hypothetical silane molecules with diamond or similar lattices using the semi-empirical quantum mechanical AM1 method by scientists at Murdoch University. Densities of states and infrared spectra were calculated and compared with experimental data.

Clare B W, Jennings P J, Cornish J C L, Talukder G, Lund C P & Hefter G T 1993 Simulation of the electronic and vibrational structure of hydrogenated amorphous silicon using cluster models. Journal of Computational Chemistry 14:1423-1428

Note from the Hon Editor: This column helps to link the various disciplines and inform others of the broad spectrum of achievements of WA scientists (or others writing about WA).

Contributions to "Recent Advances in Science in Western Australia" are welcome, and may include papers that have caught your attention or that you believe may interest other scientists in Western Australia and abroad. Papers in refereed journals, or books, chapters and reviews will be accepted. Abstracts from conference proceedings will not be accepted. Please submit short (2-3 sentences) summaries of recent papers, together with a copy of the title, abstract and authors' names and addresses, to the Honorary Editor (c/o Western Australian Museum) or a member of the Publications Committee: Dr S D Hopper (Life Sciences), Dr A E Cockbain (Earth Sciences), and Assoc. Prof. G Hefter (Physical Sciences). Final choice of articles is at the discretion of the Hon Editor.

"Letters to the Editor" concerning scientific issues of relevance to this journal are also published at the discretion of the Hon Editor. Please submit a word processing disk with letters, and suggest potential reviewers or respondents to your letter. *PC Withers, Hon Editor, Journal of the Royal Society of WA*